Team code⇒ TY9-2A
Team Member 1: Name : AAMAN SHAIKH
Roll no: 53
Mobile no: 7710869106
Team Member 2: Name : SANMITH SHETTY
Roll no: 56
Mobile no: 7045098501
Team Member 3: Name : ABHISHEKH SHETTY
Roll no: 55
Mobile no: 7039531653
Tentative Title: ***AI-Based Multi-Cancer Detection: Lung, Blood, and Skin***

Domain: **MEDICAL**
Sub-Domain:Blood,Lung and Skin Cancer

Objective Description

The objective of this project is to design and evaluate AI-driven models for the early detection and accurate classification of lung, blood, and skin cancers using medical imaging and clinical datasets. By leveraging deep learning architectures, transfer learning, ensemble approaches, and explainable AI (XAI), the project aims to:

- **Develop automated diagnostic systems capable of identifying cancerous and non-cancerous samples in lung CT scans, blood smear images, and dermoscopic skin images.**

- **Compare and analyze the performance of various machine learning and deep learning models (e.g., CNNs, YOLO, ensemble methods) for multi-cancer detection.**

- **Enhance diagnostic accuracy, speed, and reliability compared to traditional manual methods.**

- **Integrate explainable AI techniques to ensure transparency, trust, and clinical relevance of model predictions.**

- **Provide a generalized multi-cancer framework that supports healthcare practitioners in early diagnosis, thereby reducing mortality rates and improving patient outcomes.**

Team Member 01: Name : AAMAN SHAIKH

PICO 1

Paper Title: ***Blood cancer prediction model based on deep learning technique***
Authors of paper: Amr I. Shehta, Mona Nasr & Alaa El Din M. El Ghazali

Paper Description:

- **Problem Statement: Blood cancer is one of the deadliest diseases globally, often diagnosed late, leading to high mortality rates. Traditional diagnostic methods are time-consuming and prone to errors. Hence, there is a need for automated, accurate, and fast AI-driven diagnostic methods.**

- **Intervention: Application of deep learning architectures (ResNetRS50, RegNetX016, AlexNet, ConvNext, EfficientNet, Inception_V3, Xception, and VGG19) trained on leukemia image datasets to detect blood cancer at an early stage.**

- **Comparison: The performance of different deep learning models was compared in terms of accuracy, error rates, and processing time. ResNetRS50 was found superior to others.**

- **Outcome: ResNetRS50 achieved the best accuracy and speed with minimal error rates, demonstrating potential to enhance early detection, reduce mortality, and support clinical decision-making.**

PICO 2

Paper Title: ***Explainable AI in Diagnosing and Anticipating Leukemia using Transfer Learning Method***
Authors of paper: Wahidul Hasan Abir, Md. Fahim Uddin, Faria Rahman Khanam, and Mohammad Monirujjaman Khan

Paper Description:

- **Problem Statement: Diagnosing Acute Lymphoblastic Leukemia (ALL) is challenging, time-consuming, and error-prone. Most AI models act as black boxes, creating trust issues in healthcare. There is a lack of explainability in automated AI-based leukemia detection systems.**

- **Intervention: Use of transfer learning models (InceptionV3, ResNet101V2, VGG19, InceptionResNetV2) combined with Local Interpretable Model-Agnostic Explanations (LIME) to classify and explain ALL cell detection from microscopic images.**

- **Comparison: Accuracy and reliability of different transfer learning models were compared. The explainable AI (XAI) approach was tested against standard deep learning models without interpretability.**

- **Outcome: InceptionV3 achieved the highest accuracy (98.38%). Integration of LIME provided transparency by showing which image regions influenced predictions, making the model reliable for clinical use.**

PICO 3

Paper Title: ***Early Diagnosis of Acute Lymphoblastic Leukemia Using YOLOv8 and YOLOv11 Deep Learning Models***
Authors of paper: Alaa Awad and Salah A. Aly

Paper Description:

- **Problem Statement: Existing leukemia detection studies mainly use single-cell datasets, which limit real-world applicability. Misclassification of hematogones as ALL is a recurring challenge, reducing diagnostic reliability.**

- **Intervention: Implementation of YOLOv8 and YOLOv11 deep learning object detection models with data augmentation and transfer learning for automated multi-cell blood smear analysis.**

- **Comparison: Performance of YOLOv8 and YOLOv11 was compared with existing methods (MobileNetV2, attention mechanisms, traditional CNNs) in terms of classification accuracy, speed, and ability to differentiate hematogones.**

- **Outcome: Both YOLOv8 and YOLOv11 achieved high accuracy (up to 98.8%), correctly distinguishing malignant from benign cells, including hematogones, and proved robust in real-world, multi-cell datasets.**

PICO 4

Paper Title: ***DVS: Blood Cancer Detection Using Novel CNN-Based Ensemble Approach***
Authors of paper: Dr. Md Taimur Ahad, Israt Jahan Payel, Bo Song, Yan Li

Paper Description:

- **Problem Statement: Manual diagnosis of blood cancers using peripheral blood smears (PBS) is time-consuming, error-prone, and not scalable for large datasets. Single CNN architectures often suffer from overfitting and lack generalization.**

- **Intervention: Development of an ensemble CNN-based model (DVS) integrating multiple architectures such as VGG19, ResNet152v2, SEresNet152, ResNet101, and DenseNet201 with transfer learning to improve classification accuracy.**

- **Comparison: Performance of individual CNN models was compared against the proposed ensemble approach. Metrics included accuracy, precision, and robustness across diverse datasets.**

- **Outcome: The DVS ensemble model outperformed individual CNNs, achieving 98.76% accuracy, making it the most reliable and effective for automated blood cancer detection and classification.**

PICO 5

Paper Title:

A Hybrid Feature Fusion Deep Learning Framework for Leukemia Cancer Detection in Microscopic Blood Sample Using Gated Recurrent Unit and Uncertainty Quantification

Authors of Paper:

Maksuda Akter, Rabea Khatun, Md Manowarul Islam [arXiv]()

Paper Description:

- **Problem Statement:**
Acute Lymphoblastic Leukemia (ALL) is a highly aggressive and the most common form of leukemia, affecting both children and adults. Traditional diagnostic methods—like manual microscopy and

cytochemical tests—are expensive, time-consuming, and rely heavily on expert interpretation. Additionally, existing AI-based approaches often lack the ability to quantify the uncertainty in their predictions, raising concerns about misdiagnoses in critical clinical scenarios. arXiv

- **Intervention:**
  The researchers propose a hybrid deep learning framework combining Convolutional Neural Networks (CNNs) with Gated Recurrent Units (GRUs) to enable feature fusion, enhanced temporal/spatial modeling, and classification. They also incorporate uncertainty quantification methods—including Bayesian optimization for hyperparameter tuning and deep ensemble techniques—to provide confidence estimates for each prediction. Models tested include InceptionV3-GRU, EfficientNetB3-GRU, and MobileNetV2-GRU. arXiv

- **Comparison:**
  The hybrid models were compared against each other and evaluated across different datasets—ALL-IDB1, ALL-IDB2, and a combined set—to benchmark performance. The framework was effectively compared against standard CNN-only approaches lacking uncertainty quantification. arXiv

- **Outcome:**
  The proposed hybrid feature fusion models achieved exceptional classification performance:

  - **100% accuracy on ALL-IDB1**
  - **98.07% accuracy on ALL-IDB2**
  - **98.64% accuracy on the combined dataset**
    Additionally, uncertainty quantification enhanced model reliability by highlighting prediction confidence and reducing the likelihood of misdiagnosis

Team Member 02: Name :SANMITH SHETTY

PICO 1

Paper Title: ***A randomized Phase II trial of Pioglitazone for lung cancer chemoprevention in high-risk current and former smokers***

Paper Description:

- **Population: High-risk current or former smokers with endobronchial dysplasia.**
- **Intervention: Pioglitazone for 6 months.**
- **Comparator: Placebo.**
- **Outcomes: Histologic improvement of dysplasia (Max histology), Ki-67 index, and progression to squamous cell carcinoma.**
- **.**

PICO 2

Paper Title: ***Systematic review and meta-analysis of preoperative physical exercise interventions in NSCLC patients***

- **Problem Statement (P):**
  Lung cancer surgery is associated with poor postoperative outcomes. Patients often have low baseline physical capacity, and there is uncertainty if prehabilitation improves surgical readiness and recovery.
- **Intervention (I): Structured preoperative exercise/prehabilitation programs.**
- **Comparison (C): Usual care or no exercise.**

- **Outcome (O): Better functional capacity, mental wellbeing, and perioperative medical outcomes.**

PICO 3

Paper Title: ***Virtual randomized trial: Lobectomy versus stereotactic ablative radiotherapy in stage IA NSCLC***

- **Problem Statement (P):**
  For early-stage operable NSCLC, lobectomy is standard but invasive. SABR offers a non-invasive alternative, but direct randomized comparisons are lacking due to feasibility and ethics of such trials.

- **Intervention (I): Lobectomy.**

- **Comparison (C): SABR.**

- **Outcome (O): Survival, disease control, and treatment effectiveness.**
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PICO 4

Paper Title: *Cloud-based Lung Tumor Detection and Stage Classification using M-CNN (Cloud-LTDSC)*

- **Problem Statement (P):**
  Accurate staging of lung cancer is essential but manual staging is complex and error-prone. Existing CAD systems are computationally heavy and not easily scalable across clinical centers.

- **Intervention (I):** Cloud-based M-CNN model with active contour segmentation for staging.

- **Comparison (C):** Existing tumor staging techniques.
- **Outcome (O):** Improved accuracy in staging, scalability via cloud deployment, reduced processing time.

PICO 5

Paper Title: *Cloud-Based Lung Tumor Detection and Stage Classification Using Deep Learning Techniques*

Problem Statement (P):
Lung cancer staging is critical for treatment planning, but manual staging using CT scans is complex, time-consuming, and prone to error. Traditional CAD systems lack scalability and computational efficiency for large-scale clinical use.

Intervention (I):
Cloud-based deep learning framework (M-CNN with active contour segmentation) for automated lung tumor detection and stage classification.

Comparison (C):
Existing conventional staging and detection methods without cloud deployment.

Outcome (O):
Improved accuracy in tumor stage classification, reduced computational load, faster processing, and scalability across multiple clinical centers via cloud integration.

Team Member 03: Name :ABHISHEKH SHETTY

M3_PICO 1

Title: Advancing Skin Cancer Prediction Using Ensemble Models

Authors: Priya Natha & Pothuraju RajaRajeswari

- **Problem Statement (P):** Manual diagnosis of skin cancer is subjective, time-consuming, and prone to errors. There is a need for automated and reliable predictive tools.

- **Intervention (I):** Ensemble models (AdaBoost, CatBoost, Random Forest, Gradient Boosting, Extra Trees) with **genetic algorithm-based feature optimization** and combined through Max Voting.

- **Comparison (C):** Performance of individual models alone versus the ensemble Max Voting approach.

- **Outcome (O):** Achieved **95.80% accuracy** with higher F1-score, recall, and precision compared to standalone models → proving the ensemble system is superior.

M3_PICO 2

Title: Skin Cancer Prediction Model using Deep Learning

Authors: Annaji Kuthe, Harshal Donarkar, Charul Patel, Mahek Qureshi, Angad Bawankar, Kunal Gawande

- **Problem Statement (P):** Traditional detection of multiple skin lesion types is slow and error-prone, requiring robust AI support.
- **Intervention (I):** CNN (Convolutional Neural Network) trained on **ISIC 2024 dataset** with oversampling and augmentation techniques to address class imbalance.
- **Comparison (C):** Traditional/manual dermatological assessments and earlier shallow ML models.
- **Outcome (O):** CNN performed "exceptionally well" with strong classification results across 7 lesion types → enhancing **speed and accuracy of screening**.

M3_PICO 3

Title: Advancing Skin Cancer Prediction: A Deep Dive into Hybrid PCA-Autoencoder

Authors: Priya Natha & Pothuraju RajaRajeswari

- **Problem Statement (P):** High-dimensional features in skin cancer datasets reduce efficiency and predictive power.
- **Intervention (I): Hybrid dimensionality reduction** method using PCA (Principal Component Analysis) + Autoencoder to extract

optimized features.

- **Comparison (C):** Prediction models without hybrid feature selection (using raw or only PCA/Autoencoder separately).
- **Outcome (O):** The hybrid approach achieved **higher accuracy, precision, and recall**, proving that combining PCA with Autoencoder improves prediction robustness.

M3_PICO 4

Title: Optimizing Skin Cancer Survival Prediction with Ensemble Techniques

Authors: E. Erum Yousef, Z. Abbasi, Zhongliang Deng, A. Arif, Hussain Magsi, Q. Qasim Ali

- **Problem Statement (P):** Predicting survival outcomes in skin cancer patients is challenging due to heterogeneous patient/tumor characteristics.
- **Intervention (I):** Ensemble machine learning techniques combining multiple base classifiers to improve survival prediction.
- **Comparison (C):** Individual machine learning models versus ensemble approaches.
- **Outcome (O):** Ensembles significantly improved predictive accuracy and reliability for survival outcomes, supporting **better clinical decision-making**.

M3_PICO 5

Title: Transfer Learning with Ensembles of Deep Neural Networks for Skin Cancer Detection in Imbalanced Data Sets

Authors: *Aqsa Saeed Qureshi & Teemu Roos*

- ***Problem Statement (P):*** *Skin cancer datasets are highly imbalanced (few malignant vs. many benign cases), making accurate prediction difficult.*

- ***Intervention (I): Transfer learning*** *using ensembles of deep CNNs (ResNet, Inception, EfficientNet) fine-tuned on dermatoscopic images.*

- ***Comparison (C):*** *Standard CNNs trained from scratch or single pre-trained models.*

- ***Outcome (O):*** *Ensemble of transfer-learning models improved* ***classification accuracy and robustness on imbalanced datasets****, reducing misclassification of malignant lesions.*

DRIVE LINK :

https://drive.google.com/drive/folders/1PVNJ42V2wwfZogIWqWf0y44EOi1EWdCv?usp=sharing